

room temperature for 24 hours to determine whether it appeared normal or not, and further to carry out a peeling test with a cellophane tape. Water resistance was assayed depending on the below observations

○: an applied membrane did not appear abnormal, and further did not swell nor peel.

×: an applied membrane swelled or peeled.

(5) Water solubility of a resin composition:

100 parts of an aqueous 1% sodium carbonate solution was added to 100 parts of each of the resin compositions of Example 1 and Example 2 to stir, resulting in dissolving uniformly. 100 parts of water was added to 100 parts of each of the resin compositions of Example 3 and Example 4 to stir, resulting in dissolving uniformly. On the other hand, 100 parts of an aqueous 1% sodium carbonate solution or water was added to 100 parts of the resin composition of Comparative Example to stir, resulting in undissolving to separate.

○: dissolving in (alkali) water

×: undissolving in (alkali) water

Table 1

| | Example | | | Comparative Example | |
|--------------------------|---------|----|-----|---------------------|----|
| | 1 | 2 | 3 | 4 | 1 |
| Urethane oligomer (A-1) | 70 | | | | |
| Urethane oligomer (A-2) | | 70 | | | |
| Urethane oligomer (A'-1) | | | 175 | | |
| Urethane oligomer (A'-2) | | | | 218 | |
| KAYARAD UX-6101 *1) | | | | | 70 |
| KAYARAD PEG400DA*2) | 20 | | 30 | 15 | 20 |
| KAYARAD R-167 *3) | 10 | | | | 10 |
| KAYARAD TMPTA *4) | | 15 | | 10 | |
| Acryloyl morpholine | | 15 | | 5 | |
| Darocure 1173 *5) | 1 | 1 | 1 | 1 | 1 |
| ----- | | | | | |
| (1) Curing | ○ | ○ | ○ | ○ | ○ |
| (2) Adhesion | ○ | ○ | ○ | ○ | ○ |
| (3) Pencil hardness | H | H | HB | HB | H |
| (4) Water resistance | ○ | ○ | ○ | ○ | ○ |
| (5) Water solubility | ○ | ○ | ○ | ○ | × |

(Note)

*1: Urethane acrylate (made by NIPPON KAYAKU KK)

*2: Polyethylene glycol diacrylate

(made by NIPPON KAYAKU KK)

*3: 1,6-hexane diol diglycidyl ether diacrylate

(made by NIPPON KAYAKU KK)

*4: trimethylol propane triacrylate

(made by NIPPON KAYAKU KK)

*5: 2-hydroxy-2-methyl-1-phenyl-propane-1-one

(made by Ciba Speciality Chemicals KK)

The results of Example 1 to 4 and Comparative Example 1 reveal that the resin compositions of the present invention can be diluted with water and are excellent in curing-property.

Example 5 to 20 and Comparative Example 2 to 5

The components were mixed at the rates as shown in Table 2 and blended by a three-roll mill to prepare the principal agents {formulation components (XA-1)-(XA-5) and (XX-1)-(XX-2)}. On the other hand, the thermosetting components (F) (the epoxy resins) were used at the rates as shown in Table 3 for the curing agents {formulation components (H-1)-(H-4)}. The above principal agents and the curing agents were mixed at the combinations as shown in Table 4 to prepare the soldering resist compositions for use.